STATEMENT OF WORK

Requisition #278414

Title: Evaluation of Sodium Borate Solution Deployment to Certain Hanford Waste Storage Tanks for Criticality Control

Revision Number: 0

Date: April 29th, 2015

Prior SOW or Revision Date: N/A

1.0 Objective

Washington River Protection Solutions, LLC (WRPS) requires a Subcontractor to perform an evaluation of the potential deployment of a sodium borate solution as a criticality control measure in certain Hanford waste storage tanks containing particulate fissile material not co-precipitated with neutron absorbers. This evaluation is in support of the "robust control" development identified in RPP-RPT-56983/24590-WTP-RPT-MGT-14-022, "One System Report on Plutonium Particulate Criticality Safety Issue Resolution at Hanford Tank Farms and Waste Treatment Plant".

2.0 Background/Introduction

RPP-13033 Tank Farms Documented Safety Analysis section 5.5.3.5.2 states:

"RPP-RPT-50941, *Review of Plutonium Oxide Receipts into Hanford Tank Farms,* identified eight tanks that may have received more than the minimum critical mass (> 450 g) of large particle size PuO2 or Pu metal (241-TX-105, 241-TX-109, 241-TX-118, 244-TX, 241-SY-102, 241-C-102, 241-AN-101, and 241-S-108). There is the potential for sludge disturbing activities to segregate large particle size PuO2 or Pu metal due to gravity segregation. Such segregation could, potentially, change the distribution of the fissile material in the tank (change the association of this fissile material with neutron absorbers). Sludge disturbing activities within these tanks are prohibited until a criticality safety evaluation is completed demonstrating that nuclear criticality remains "beyond extremely unlikely" for the activity (i.e., RPP-50963, RPP-51388, RPP-51423, RPP-53112, and RPP-53817)."

RPP-RPT-56983/24590-WTP-RPT-MGT-14-022 identified a number of recommended actions. One action was to investigate what were termed as "robust controls" that could be implemented to address the criticality safety concerns associated with the presence of large particle size Pu species. Use of a soluble neutron absorber was identified as a potential "robust control". The report recommended the following:

"An engineering study on the potential neutron absorbers and their application should be performed in FY-14. If suitable absorbers are identified, and input from the Segregation and Pu-Bi actions identifies a need, follow on work in FY-15 would evaluate optimal locations to introduce absorbers into the system as part of a criticality safety strategy (i.e., CSER). This action will be led by TOC Engineering, with input from WTP E&NS and WTP Process Engineering."

A study of potential neutron absorbers was completed (RPP-RPT-58208, Identification and Evaluation of Soluble Neutron Poisons for Large Dense Plutonium Particulate Tank Waste).

Boron in a sodium pentaborate solution was identified as a soluble neutron poison that could potentially be used in Hanford waste tanks. The evaluation being performed under this scope of work is the follow on activity identified in the RPP-RPT-56983/24590-WTP-RPT-MGT-14-022 recommendation.

3.0 Scope

The purpose of this task is to perform an engineering evaluation of how a sodium pentaborate solution could be deployed as a criticality control in support of retrieval of tanks SY-102, TX-109 and TX-118 in accordance with current plans. This evaluation is not a criticality safety evaluation. The evaluation will rather be predicated on the premise that we have already identified a suitable concentration of boron that has to be maintained in the tanks during retrieval activities. The scope of the evaluation therefore shall focus on the following aspects of such a deployment:

- How the sodium pentaborate solution is to be introduced into the tank;
- How do we ensure that the required boron concentration is achieved in the areas of the tank where it is needed (e.g. mixing and distribution requirements);
- The mass/volume of sodium pentaborate required to complete the retrieval of each of the three tanks;
- Potential impacts on waste tank chemistry and waste compatibility resulting from the sodium borate addition;
- How the boron concentration is to be monitored, controlled and verified;
- Potential removal or dilution of the boron during tank retrieval;
- Potential degradation of the boron in the tank, to include potential for precipitation;
- Potential downstream process effects due to sodium pentaborate addition, to include both processing in the tank farms and 242-A evaporator and at the Waste Treatment and Immobilization Plant (WTP) Pretreatment Facility.

The Subcontractor will prepare a technical report documenting the results of the deployment evaluation. In addition to the bulleted items above, the report will explicitly evaluate the feasibility of sodium pentaborate deployment in each of the three candidate tanks. The Subcontractor will prepare the submittals identified in section 4.0.

Reference materials required for review in support of this work include, but are not limited to the following:

Table 3-1: Reference Materials[1]

1.	RPP-13033, "Tank Farms Documented Safety Analysis", sections 5.5.3.5, and 6.0
2.	RPP-RPT-50941, Review of Plutonium Oxide Receipts into Hanford Tank Farms
3.	RPP-RPT-56983/24590-WTP-RPT-MGT-14-022, "One System Report on Plutonium Particulate Criticality Safety Issue Resolution at Hanford Tank Farms and Waste Treatment Plant"
4.	RPP-RPT-58208, Identification and Evaluation of Soluble Neutron Poisons for Large Dense Plutonium Particulate Tank Waste
5.	HNF-SD-WM-OCD-015, "Tank Farms Waste Transfer Compatibility Program"
6.	ANSI/ANS-8.14-2004 Section 4.2.

[1] Use latest revision where available.

The draft evaluation report will be reviewed by WRPS Mission Analysis Engineering Staff, with written comments provided to the Subcontractor. Both comments and comment resolutions will be in written form and documented. The Subcontractor will be responsible to resolve comments. Once resolved, the Subcontractor will prepare the final evaluation report for WRPS approval.

4.0 Submittals

In support of the work scope established in Section 3.0 above, submittals are listed on the Master Submittal Register (MSR).

Submittals shall be provided using the TOC Incoming Letter of Transmittal (form A-6005-315). All transmittal subject headings shall contain, at a minimum, the subcontract number, submittal number, and submittal description.

Submittals shall be provided in electronic format unless available only as a hard copy. Electronic submittals may be sent to TOCVND@rl.gov or delivered via a WRPS designated File Transfer Protocol (FTP) site. Electronic formats must be non-password protected in one of the following formats:

- Microsoft® Office Compatible
- Portable Document Format (PDF)
- Tagged Image File Format (TIFF)
- Graphics Interchange Format (GIF)
- Joint Photographic Experts Group (JPEG)
- Windows Media Video (WMV)
- Moving Picture Expert Group (MPEG)
- Extensible Markup Language (XML)
- HyperText Markup Language (HTML)
- Comma Separated Values (CSV)
- Text (TXT)

5.0 Acceptance Criteria

Work products and services provided must meet established TOC procedures for control and review of work products, where applicable. These procedures include:

- TFC-ENG-DESIGN-C-25, "Technical Document Control"
- TFC-ENG-DESIGN-C-10, "Engineering Calculations"
- TFC-BSM-AD-STD-02, "Editorial Standards for Technical Documents"

This report will be considered a General Document or Report as per Table 1 of TFC-ENG-DESIGN-C-25. If the report includes calculations it is expected that they will meet the requirements of TFC-ENG-DESIGN-C-10 for calculations included in other technical documents.

6.0 Configuration Management and Standards

6.1 Configuration Management Requirements

Configuration management requirements for this Release are based upon the types of engineering services being procured and include the TOC standards listed in Section *6.2 Applicable Standards* and the statements below.

New or revised Technical Documents shall be prepared in accordance with TFC-BSM-AD-STD-02, *Editorial Standards for Technical Documents* and meet the document release criteria found in Table 3 of TFC-ENG-DESIGN-C-25, Technical *Document Control.*

6.2 Applicable Standards

There are no engineering codes or standards applicable to this scope of work. Note that ANSI/ANS 8.14-2004 "Use of Soluble Neutron Absorbers in Nuclear Facilities Outside Reactors" is not invoked for this scope of work, however section 4.2 of the standard

contains design requirements and recommendations which were considered in the bulleted items in section 3.0 of this SOW. As such, that portion of the standard is listed as a reference.

7.0 ESH&Q Requirements

7.1 Quality Assurance Requirements

The Subcontractor shall follow standard commercial quality practices.

7.2 Price-Anderson Amendments Act Requirements

This 7.2 section and the General Provisions Article 2.11 entitled, *Price-Anderson Amendments Act (PAAA),* are both determined to be N/A.

7.3 Special ESH&Q Requirements

Preliminary hazard assessment PHA ID: 31 is to be used for general office duties performed in TOC-controlled office facilities only. Prior to performing any activities outside of the office facility, a job hazard analysis (JHA) must be completed to cover the activities to be performed. The JHA must be approved by a TOC Safety Representative.

8.0 Verification/Hold Points

There are no verification/hold points associated with this scope of work.

9.0 Reserved

10.0 Work Location/Potential Access Requirements

Work will be performed at the Subcontractor's facilities and at the Hanford site. The Subcontractor must be prepared to make periodic visits to Hanford Site administrative/office areas (3170 George Washington Way, 2425 Stevens Center, 200 East/West Area, etc.). Site visits may be required to perform reviews and coordination of activities, as well as perform interviews with WRPS personnel to collect information for the evaluation.

11.0 Training

The Subcontractor is expected to provide appropriately trained and qualified staff to perform the type of work specified. This shall include necessary expertise and training including necessary continuing training programs to assure Subcontractor personnel maintain a current understanding of laws, requirements, and industry standards. The Subcontractor shall maintain company and regulatory required certifications and qualifications for personnel.

The Subcontractor shall be responsible for all costs associated with training and/or continuing education for Subcontractor employees that are not Hanford-specific training courses (e.g. commercially available training for certifications, etc.). Hanford-specific training courses will be scheduled by WRPS at no additional cost to the Subcontractor.

Subcontractor personnel required to be on site for more than six consecutive days in support of this subcontract shall, at a minimum, complete Hanford General Employee Training (HGET).

12.0 Qualifications

Minimum Qualifications: BS degree or equivalent in chemical, mechanical or nuclear engineering. The individual(s) responsible for performing the evaluations ("responsible engineer(s)") shall have at least 10 years of relevant experience, of which at least 5 years shall be with a Department of Energy (DOE) or commercial nuclear facility. The responsible engineer(s) may be assisted by engineers or other technical staff with less experience. The responsible engineer(s) shall have at least a basic knowledge of criticality control principles in process vessels and equipment.

The assigned Subcontractor personnel shall be familiar with DOE engineering practices and Hanford Site tank farms waste storage, transfer, support, and feed delivery systems. Additionally, at a minimum the responsible engineer(s) shall have demonstrated familiarity with planned Hanford double-shell tank sludge retrieval using dual mixer pumps or sluicing, and with Hanford single-shell tank sludge and saltcake retrieval technologies planned to be employed for TX-farm tanks. Assigned personnel shall possess strong technical writing skills and shall have demonstrated prior experience performing process evaluations of this nature.

13.0 Special Requirements

Use of Government Vehicles

There is no anticipated need for any Subcontractor employees to use a Government-furnished vehicle in the performance of this statement of work. The Subcontractor's employees, therefore, are specifically prohibited from driving any Government-furnished vehicles under the performance of this statement of work unless this statement of work is formally so modified by the parties and the employee(s) will present a valid driver's license to the BTR for review.

Government Property

No government-owned property will be provided to the Subcontractor, therefore, this requirement does not apply.

14.0 Reporting/Administration

Subcontractor information including reports and other documents shall be submitted in either hard copy or electronic format as designated by WRPS. If electronic formatted documents are required, the documents must be viewable using Microsoft ® Windows®, Microsoft® Office, or Adobe® Acrobat® software. Assigned personnel are required to:

- Attend status meetings as requested. Status meetings shall initially be weekly. Periodicity may be adjusted by the Technical Point of Contact with concurrence from the subcontractor as the contract progresses.
- Provide weekly schedule status reports as directed by the Technical Point of Contact, BTR or designee.
- Attend Safety meetings as directed by the BTR.

15.0 Workplace Substance Abuse Program Requirements

A Workplace Substance Abuse Program is not required for this SOW.